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ERROR DETECTION IN SEISMIC DATA

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(56) Prior Art Documents
US 5148494
US 4492476

(57) Claim

1.   Apparatus for detecting errors in frames of seismic data capable of being presented as
images, such images being expected to exhibit an inherent symmetry about an axis, the
apparatus comprising:

a storage device for storing a frame of seismic data capable of being presented as an
image;

a selection device for selecting an axis within the image as the axis of symmetry;

a divider for dividing the data about the axis of symmetry to create first and second sets
of data, wherein the divider includes a mirroring means for re-ordering the data in the first set
of data so that it can be presented by an image which would be the mirror image of the image
previously representing the set; and

a comparison means for comparing the re-ordered first set of data and second set of
data according to preselected matching criteria to determine, based on the degree of matching,
whether the extent of mismatch in the frame of data is within a predetermined tolerance and,
if it is, to indicate the frame of seismic data is valid.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1.   Apparatus for detecting errors in frames of seismic data capable of being presented as images, such images being expected to exhibit an inherent symmetry about an axis, the

5   apparatus comprising:

        a storage device for storing a frame of seismic data capable of being presented as an image;

        a selection device for selecting an axis within the image as the axis of symmetry;

        a divider for dividing the data about the axis of symmetry to create first and second sets

10 of data, wherein the divider includes a mirroring means for re-ordering the data in the first set of data so that it can be presented by an image which would be the mirror image of the image previously representing the set; and

        a comparison means for comparing the re-ordered first set of data and second set of data according to preselected matching criteria to determine, based on the degree of matching,

15 whether the extent of mismatch in the frame of data is within a predetermined tolerance and, if it is, to indicate the frame of seismic data is valid.

2.   Apparatus as claimed in claim 1, wherein the comparison means comprises:

        a matching device for comparing the first and second sets of data to determine the

20 degree of matching between such sets; and

        decision logic, responsive output from the matching device, to determine whether the extent of mismatch is within the predetermined tolerance.

3.   Apparatus as claimed in claim 2, wherein the comparison means further comprises:

25   an edge detector for determining the data points representing discontinuities in the image, and to create an edge list of such data points, such edge lists being used as the basis of comparison by the matching device.

4.   Apparatus as claimed in claim 3, wherein the divider operates on the whole frame of

30 seismic data prior to passing the first and second sets of data separately through the edge

detector, the edge lists created by the edge detector being received by the matching device for comparison.

5. Apparatus as claimed in claim 3, wherein the edge detector operates on the whole frame of seismic data and then the edge list is operated on by the divider so as to create two edge lists as the first and second sets of data for comparison by the matching device.

6. Apparatus as claimed in claim 1, wherein the mirroring means re-orders the first set of data created by the divider by employing a buffer in which to store data from that set of data constituting a row of an image, the contents in the buffer then being read out in reverse order and stored as the re-ordered first set of data.

7. Apparatus as claimed in any preceding claim, wherein the selection device is an amplitude peak detector which selects the axis of symmetry as the position in the data having the highest detected intensity.

8. Apparatus as claimed in any of claims 1 to 6, wherein the selection device uses information contained in the seismic data, giving the positioning of the shot for that frame of data, to select an axis as the axis of symmetry.

9. Apparatus as claimed in any of claims 3 to 8, wherein the edge detector employs a canny edge detection algorithm in order to identify the data points representing edges.

10. Apparatus as claimed in any preceding claim, wherein the matching device uses a stereo matching algorithm.

11. Apparatus as claimed in claim 10, wherein the stereo matching algorithm is the PMF algorithm.

12. A method of detecting errors in frames of seismic data capable of being presented as

images, such images being expected to exhibit an inherent symmetry about an axis, the method comprising the steps of:

(a) storing a frame of seismic data that can be presented as an image in a storage device;

5 (b) selecting an axis within the image as the axis of symmetry;

(c) employing a divider to divide the image about the axis of symmetry to create first and second sets of data; and

(d) comparing, in a comparison means, the sets of data according to preselected matching criteria to determine, based on the degree of matching, whether the extent of 10 mismatch in the frame of data is within a predetermined tolerance.

13. A method as claimed in claim 12, wherein the comparison step (d) comprises the steps of:

(i) comparing, in a matching device, edge lists to determine the degree of matching 15 between the edges represented by such lists; and

(ii) determining, in response to output from the matching device, whether the extent of mismatch is within the predetermined tolerance.

14. A method as claimed in claim 13, wherein the comparison step (d) further comprises, 20 prior to the comparing step (i), the step of:

(iii) determining, in an edge detector, the data points representing discontinuities in the image, and creating an edge list of such data points, such edge lists being used as the basis of comparison by the matching device.

25 15. A method as claimed in any one of claims 12 to 14, wherein the dividing step (c) is performed prior to any of the steps in comparison step (d).

16. A method as claimed in claim 14, wherein the edge detection step (d)(iii) is performed on the whole frame of data and then the edge list is used as the input for step (c) so as to create 30 two edge lists as the first and second sets of data for comparison at step (d)(i).

17.   A method as claimed in any one of claims 12 to 16, wherein the dividing step (c) includes a mirroring step which re-orders the data in the first set of data so that it can be represented by an image which would be the mirror image of the image previously representing that set, the comparison step (d) then comparing the second set of data with the

5 re-ordered first set of data.

18.   Apparatus for detecting errors in frames of seismic data substantially as hereinbefore described with reference to the accompanying drawings.

10 19.   A method of detecting errors in frames of seismic data substantially as hereinbefore described with reference to the accompanying drawings.

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ABSTRACT

ERROR DETECTION IN SEISMIC DATA

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The present invention relates to the detection of errors in seismic
data and in particular to apparatus for detecting errors in frames of
seismic data that can be presented as images. Due to the techniques used
for collecting seismic data, an image produced to represent that data
will typically be expected to exhibit an inherent symmetry about an axis.
The apparatus of the present invention comprises a storage device for
storing a frame of seismic data which can be presented as an image, a
selection device for selecting an axis within the image as the axis of
symmetry, and a divider for dividing the data about the axis of symmetry
to create first and second sets of data. Further it includes a
comparison means for comparing the sets of data according to preselected
matching criteria to determine, based on the degree of matching, whether
the extent of mismatch in the frame of data is within a predetermined
tolerance.

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